XIX.—*On the Genera* Pinus *and* Abies, *with Remarks on the Cultivation of some Species.* By Capt. S. E. Cook, R.N.*

The extraordinary interest which has been excited by the introduction of the various species of *Pinus* within the last few years, may make a few observations respecting them, more especially on their œconomic value, acceptable.

By the zeal and activity of our own and foreign collectors, seconded by the assistance of various bodies and of wealthy individuals, we are provided with a list of about seventy species of *Abies* and *Pinus*, exclusive of the junipers, cedars and other kindred *Coniferæ* which now ornament our collections. The greater part of these may be considered as well-defined species or varieties; whilst, as is inevitable from the comparative novelty of the subject, and the want of public gardens and repositories for the purpose of standard reference, which to the discredit of the authorities and the prejudice of the public good we are yet without, a portion derive their appellations from the gratuitous assistance of those who are interested in multiplying names, and frequently confer them where no real distinction exists.

It would be impossible within moderate limits to give even a short notice of this long list individually. At present it is intended merely to form them into groups, reserving more detailed observations for the Europæan species, which are by far the most interesting in a national and œconomical point of view.

We propose to divide the seventy species above-mentioned into the following groups: 1st. *Old America*, if we may use the expression, which includes the United States west of the Mississippi, and Canada with Labrador, and extends to the limits of vegetation to the north. 2nd. Those species which are produced in the magnificent range which separates the waters of the Atlantic from those of the Pacific, commonly known by the barbaric appellation of the Rocky Mountains, for which the "Northern Andes" or some native term, if such could be obtained, ought to be substituted. This, which at present forms about fifteen species, we shall designate by the name of

* Read in the Section of Zoology and Botany at the Meeting of the British Association, Newcastle, and communicated by the Author.

the "*Douglas group*," as we owe most of our knowledge respecting it to that lamented traveller, whose memory well deserves such a compliment. The 3rd is that of the uplands of Mexico, of which we already possess a few specimens. The 4th is composed of the species newly discovered to clothe parts of the Himalaya mountains. The 5th is that of Europe.

We should gladly make another division of the Caucasus and mountains of the north of Asia, but as yet our information is too incomplete to enable this vast portion of the globe to be regularly placed in the series.

The first group, that of the United States and Canada, presents every variety of form and size to the number of about twenty species. Of the whole of this list, although many of them are of the noblest port and dimensions, none produce timber of more than second-rate quality, and the greater part only of very inferior value. Many of these kinds are found in the depth of enormous and primæval forests, where they are sheltered from every wind, and draw their nourishment from the richest alluvial soil covered by the successive vegetable deposits of countless ages, in a climate where a severe but steady winter is rapidly succeeded by an almost tropical summer. We can easily imagine that under these circumstances the rapid growth of timber may be fatal to the solidity of its texture, and consequently to its durability; but how are we to account for the same quality pervading that of the species which are grown on dry and sandy or rocky uplands, or on the bleak coast of Labrador, in climates resembling those of Russia and Norway, in which our finest timber is produced? Such, however, is the undoubted fact, and it is equally singular that none of these species grow well in Europe, our best specimens being little more than abortive representations of the individuals they are descended from when seen in their native forests. As in the œconomic point of view, therefore, they can neither be considered as very useful nor even ornamental, we shall not make any further remark upon them.

Far other anticipations may be indulged in respecting the Douglas group. Without being over sanguine, there is little doubt that amongst the gigantic species forming it, of which we are already acquainted with about fifteen, we shall make

some valuable additions to our woodlands. One species already known, the *Abies Douglasii*, according to the accounts transmitted to Dr. Lindley, which are fully borne out by the appearance of the timber and the growth of the young trees in every part of England, appears to possess the qualities of the larch, of durability, quick growth, and utility when young, with the advantage in some respects of being an evergreen. We earnestly entreat all cultivators to attend to this species, which, in the absence of seed, which we hope will shortly be supplied from our own trees, is readily propagated by cuttings. Our acquaintance with these Californian forests is too recent, and the habits of the people who frequent them too barbarous, to admit of our possessing much certain information respecting the nature of their timber; but as, by the munificent care of the Duke of Devonshire, collectors are now in the country for the express purpose of collecting large quantities of cones of the kinds already known, and of making further discoveries, it is to be hoped we shall soon possess more ample knowledge of them.

It is very much to be regretted that Government does not take advantage of this period of profound tranquillity, and in concert with the Fur Company cause a line of permanent settlements to be made across some parts of the chain. By this means we should obtain valuable and certain information on these and other interesting subjects; and by carrying the same system through Upper Canada, the Anglo-Saxon race would be established from Labrador to the Pacific across the whole continent of North America.

The species which have been as yet sent from Mexico are few in number and of too recent introduction, to warrant delay in giving detailed accounts of them, and it is more than probable they may be found rather remarkable as tropical species than for any superior qualities to be expected from them.

From the Himalaya range, our species, although as yet but few in number, are on a scale we should expect to find in such a chain of mountains. The Europæan species are in some degree represented amongst them, as we have silver and spruce; and there is a cedar in place of that of Western Asia. From the comparative advanced state of the inhabitants with those of the American forests, we may look for better accounts of the

quality and durability of their timber; and the enlightened patronage of the India Company, seconded by the unwearied zeal and ability of their officers, will no doubt enable us to add materially to our list of this interesting region. The *Abies Webbiana*, a gigantic silver fir, probably the noblest of the tribe, has not perfectly stood this winter near London, although it has in my neighbourhood. It may probably become inured to the climate, and the *A. Morinda*, their spruce, which has stood uninjured, well deserves attention. Both species are propagated easily by cuttings.

In the northern parts of the chain our travellers might meet with the *A. pichta*, the silver fir of the Altaian chain, which seems to be a most desirable tree to possess; and in the mean time, through the assistance of the Russian Government, which in matters of science is extremely liberal, seed might be procured in sufficient quantity to make the trial it so well deserves, as it ought to equal in hardiness if not surpass any of our Europæan species.

The last and most interesting group on the whole is unquestionably that of Europe. We are now tolerably well acquainted with the species that are spread over this portion of the globe, from the arctic circle to the shores of the Mediterranean and the confines of Asia and Africa. By far the greater part of these are of considerable, and some of surpassing value. In taking the range from south to north it will be found that the qualities of the timber become more valuable, as the tree which produces it grows naturally at a higher elevation, latitude, and level above the sea, one or both entering into this calculation. The same tree which grows spontaneously on the shores of the Baltic is never found in a similar situation on those of the Mediterranean, but as it approaches the south gradually ascends the sides of the mountains in search of a more congenial climate. We also find that there is no instance of a species which grows naturally at a low elevation producing good timber, the improvement in quality being as nearly as possible in a direct ratio from south to north, or in the degree of winter's cold they are able to resist.

To prove these positions, which we shall find afterwards to be of some importance, we shall proceed to analyse some of the principal species, following the descending scale.

We may take the *P. sylvestris,* the hardiness and good qualities of the timber of which are so well known, as a point to commence from. Two Europæan species only of *Pinus* to my knowledge claim to live at a higher elevation than the Scotch fir; these are the *P. Cembra* and *P. uncinata.* The *Cembra* grows in the very highest of the northern and central Alps, and, wherever I have seen it, above the other forests. There are a few remaining on the Montanvet at Chamouny, apparently because they were not worth removing, nearly all the good specimens in that locality being extinct. It grows in the coldest parts of Siberia. The timber is superior to that of the *sylvestris.*

In like manner the *P. uncinata* forms a complete zone in the high Pyrenees, where it is placed above the *sylvestris.* The timber is of higher value than that of its less hardy congener.

The *sylvestris* itself is found from Norway to the south of Spain, where I found two ranges of forest; one in the Sierra de Guadarrama, or great central chain of Spain, where it forms the upper zone; the other in the Sierra de Cuenca (lat. 41°), of which it occupies the northern summits, and is floated down by the western arm of the Tagus to supply Madrid with building materials. This is, as far as I know, its southern habitat. Its place in hardiness and value consequently is nearly but not quite the first.

The next in rank are two species which I shall place together, because their geographical site and elevation as well as quality seem to indicate the propriety of doing so, although they are wholly distinct from each other, the *P. Laricio* and *P. hispanica.* The *P. Laricio* is found, as far as any authentic information we possess goes, exclusively in the central parts of the lofty island of Corsica, in lat. 43°, where it grows at a moderately high elevation, and does not descend to the shores of the Mediterranean.

The *Pinus hispanica,* which as yet has been found only in Spain, I found to range from the Sierra de Segura, in lat. 39°, to the foot of the Pyrenees, in lat. 43°. It grows generally at an elevation of 2000 to 3000 feet, and not to my knowledge higher nor lower. It has erroneously been represented by some writers to extend into France. The fact is, in the locality where the forests of the *hispanica* are placed, between the

rivers Cirna and Essera, it is separated from the French territory by leagues of distance and thousands of feet of elevation. The frontier line in that part extends for a great distance amid the Siberian altitudes of the Maladetta and Mont Perdu, far above the limits of arboreal vegetation. The forest mentioned in the 'Arboretum' as at the Port de Scez, is of *uncinata*, and is Spanish and not French.

Independently of other differences between these species, which are quite distinct, the *Laricio* is highly resinous, the *hispanica* white and dry in the timber. The former tree assumes the umbellate form, which the *hispanica* does not, its growth being singularly free and elegant; and it is more clear and transparent both in the bark and foliage than its geographical neighbour.

In the scale we propose the timber of both these species ought to be of the middle quality, better than those below them, and inferior to the preceding species which are higher in the scale. This is precisely the case; and the *Laricio* is rather the better of the two, its habitat being colder than that of the southern natural site of the *P. hispanica*.

The *Pinus Pinaster*, and *Pinea*, or stone pine, are next on the list. There is little difference in the habitats of these species, or in the value of their timber. I found the *Pinaster* to occupy a regular zone below the *sylvestris*, in the central range of the Guadarrama. If there be two varieties, which is doubtful, this is identical with the Pin des Landes; and taking altitude and latitude both into account, these localities, which are about its northern limit, pretty nearly correspond with each other.

The *Pinus Pinea* has its most northern natural habitat, as far as I know, taking the elevation into account, in the plains and uplands of Old Castile, which is further north than that assigned to the *Pinaster*, but it is certainly less hardy than that species in other climates. These pines, growing thus far north and at a rather high elevation, ought to produce good timber, whilst that of both is notoriously the contrary. How does this happen? Because these northern sites are not the general or exclusive habitats of the species, both of which descend to a very low level. In the same country the *Pinea* is found growing spontaneously in the sandy wastes of Andalusia, in the Tierra Caliente of Spain, in the zone where the

palm and the cactus are found along with it; and the *Pinaster* inhabits the warm valleys of the Serrania de Ronda, at a low elevation above the Mediterranean, in a corresponding situation to which, along the coast of Provence and in the Ligurian Apennines east of Genoa, it is also met with.

These species, which are next below the *Laricio* and *P. hispanica*, produce, as follows from the localities assigned to them, timber of inferior quality to the species inhabiting the zone above them; the *Pinea* I believe being rather the better of the two.

There now remains the *halepensis*, of which three varieties are found along the shores and inlands of the Mediterranean, nearly throughout its whole extent. The three varieties are that with large red cones, which is the common, and I think only species in Spain, and is probably the more hardy; the second has small cones, and was found on the Riviere of Genoa; the third is the *P. Brutia* of Professor Tenore. There is a tree in the Botanical Garden at Naples. The northern habitat of this tree in Italy is Romagna and the Vale of Terni, and in Spain the Alcarria, a high but genial district of New Castile, where I found it abundant; below the *Pinaster* and *P. sylvestris*. Its site is thus the lowest in the Europæan series; and whilst the palm of beauty must be ceded to it beyond every other in form and colour, for œconomic purposes it is the most worthless of the tribe. A complete confirmation of the relative hardiness of this species has been afforded last winter. Near London and through the greater part of the north of the kingdom the *halepensis* may be considered to be extinct. I have lost two varieties, whilst the *P. hispanica* and *Laricio*, which were growing by their side, are wholly unscathed.

These observations embrace the principal species of the centre and west of Europe; the *P. Pumilio* is omitted, as not being a timber tree, though it is only precluded by its scanty dimensions from being in the first rank, to which its port, and hardiness appear to entitle it.

Before we proceed to the *Abies* and *Larix* we must notice two species which appear to be nearly allied, the *tatarica* or *Pallasiana*, and the *austriaca*.

The locality of the former is the Crimea, and we can scarcely,

from its occupying a district so distinct from any other, place it regularly in the European series. It is, however, beyond doubt of the upper or better class, and most probably hereafter its true place will be found amongst the zones of the Caucasus and Northern Asia.

The *austriaca*, which appears to be nearly allied to it, as they probably bear about the same relation to each other that the *hispanica* does to the *Laricio*, has been recently introduced by Mr. Lawson of Edinburgh. Not having seen or examined the forests which supply it, I cannot yet assign it a specific place; but it is no doubt entitled to a very high rank in the upper series, and promises to be a most valuable addition to our arboretum.

We now proceed to the *Larix* or common larch, which is spread from the Southern Alps to Siberia, but I believe never grows naturally at a low level, excepting far to the north. The most southern site I know it to inhabit is in the high Apennines, near their junction with the Alps in Piedmont. In this part were, and I suppose still are, as I was informed by the Piedmontese engineers, vast and almost inaccessible forests of trees of the largest dimensions. It is common in the highest Piedmontese Alps around Mont Rosa and Mont Blanc, and in ascending the Great St. Bernard is seen far above every other tree. I have little doubt, however, that it once was overtopped by the *Cembra*, which in the adjoining valley of Chamouny holds the highest zone. It thus claims the high place its hardiness and value of the timber so fully bear us out in assigning to it, on the theoretic examination of the zones it naturally inhabits.

In Scotland it appears to thrive at a higher level than the *sylvestris* by the report of the Duke of Athol; but although a most valuable and important fact, it may be from local causes, and these observations are confined to the natural position of the tree in its original forests. We shall be anxious for future information whether the larch of Siberia and of the centre of Europe be identical, of which we have some doubts; and it would be very desirable to ascertain the fact precisely, which could easily be done by correspondence with the Russian Government and the authorities of Odessa.

The *Abies* now claim our attention. We do not adopt the

fanciful term of *Picea*, and divide the class, because of the difficulty of making a true demarcation; and that the species of Europe are too scanty in number to make it necessary. Besides these reasons, the term is not truly applied, some other pines producing turpentine in greater quantities than that on which this name has been conferred.

The *Abies* do not supply us with the same extended series of observations which we have traced in the *Pinus*. They are also inferior in the absolute quality of their timber to the best of the preceding genus, and we suspect, but want data to affirm its being generally the case, that is so through the groups, and that the *Abies* fall below the *Pinus* in œconomic value. It is certainly so in the Europæan series.

The first in hardiness is the *Abies excelsa*, or common spruce, which ranges from Lapland to Savoy, south of which it is not to my knowledge found in the natural state. It certainly does not, nor ever did inhabit the Pyrenees, as asserted by some writers. It would appear to live further north than the *sylvestris*, its only neighbour in the north of Scandinavia; but it is possible, that dampness of soil, which it resists better than any of the tribe, may be the cause of this apparent greater degree of hardiness. Although its timber, which is dry and light, may not equal that of some of the kindred species in utility for some purposes, it is a most valuable tree and well worthy more attention than it has received in an œconomic point of view.

The *Abies pectinata*, or silver fir, is unquestionably less hardy than the last-mentioned species. It ranges less to the north and further to the south than either the *sylvestris* or *excelsa*. Extensive forests of it exist in the Pyrenees, where it is placed in a regular zone below the *P. uncinata* and *sylvestris*, and next above the beech. It descends into the comparatively genial climate of Navarre and the Basque Provinces, and as a variety even into Greece.

The common silver fir is not to my knowledge found beyond the Baltic, and it is probable that those reported to exist far north in the East of Europe are the *pichta* or *Altaian* species.

A variety has been recently found in Cephalonia, on which

it is to be regretted that the local name (*A. cephalonica*) should have been conferred, for there can be no doubt that the same species forms the capping found by the French Savans who recently visited that country, to cover the loftiest summits of Mount Taygetus, in the centre of the Peloponnesus, and *hellenica* or *græca* would have been a better distinctive appellation. This with the common species of Europe and the *pichta* forms three varieties, which no doubt will be found to differ in quality as in hardiness, when we have the opportunity of minutely comparing them.

These absolute zones or degrees of ability to resist the cold can only be collected by extensive observations and comparisons of many regions, but when treated on that scale are constant and unvaried. There are localities notwithstanding, where the species nearly allied in hardiness meet as upon neutral ground. The Splugen is one of these. In passing that wild mountain, five years since, I took up in the same part of the Rheinwald, plants of *P. sylvestris*, *A. excelsa*, *A. pectinata*, and *Larix europæus*, which were thus congregated; and in judging hastily it might have been inferred that the species grew naturally at the same degree in elevation, which, as we have demonstrated, would have been erroneous.

We now proceed to the application of the facts on which the foregoing observations are founded, namely, to show the practicability of cultivating some species of *Pinus* on a large scale, with a view to the increase of our national resources, and to render the payment of enormous sums annually for timber hereafter in a great part unnecessary. There is no question whatever that the Grampian mountains, instead of being as at present, in great part an unproductive waste, would, if properly managed, at a cost comparatively trifling, enable us not only to provide for our own wants, but even to export timber, instead of being, as we are at present, wholly dependent on foreign countries for this necessary of life.

We are indebted for our attention being called to this important subject by the prudent and calculating foresight of the Dukes of Athol, who in laying the foundation of enormous wealth and power for their descendants, have shown the policy which ought to be followed by the nation.

The last Duke of Athol calculated that the possessor of his woodlands on the Tay would in a few years be as rich or richer than any individual in Britain! What are these woodlands? They consist of about ten thousand acres of larch, planted in great part upon barren moor land, the aggregate value of which was a very few hundreds per annum! How different our Administrations manage these things! We are at this moment almost dependent on foreign Governments for permission to buy the timber, which, with hardly any cost, we could produce in the same way that this princely fortune has been founded. We are now actually buying larch timber to build steam boats from the Italians! We are annually laying out enormous sums for the growth of oak, of which one large portion, that of Staffordshire, is avowedly of bad quality, whilst no attempt is made to grow fir, of which a rapid and most enormous profit may easily be made. To show the relative value of an acre of larch in the north of Scotland with one of oak in the New Forest, or that of Dene, we will take the mountainous declivities of the Grampians at 2*s.* per acre; we take this value, which is very high, because Governments always purchase dear, and because only the ground best suited to the purpose should be selected. Land which would produce larch admirably in the Grampians is worth not more than 6*d.* per acre of annual rent.

In Hampshire or Staffordshire no land which will grow good oak is worth much less than 2*l.* per acre, thus making, at the high computation for larch, twenty times the value for the same extent. But by the calculations of the Duke of Athol ten acres of larch would suffice for the same purpose as seventy-five acres of oak, on account of the trees growing so closely, and that there is little ground lost. This makes a seventh or less; therefore the respective values of land in the Grampians and in the south of England, if applied in this manner, are one to one hundred and forty, and the cost of larch compared to that of oak would be the one hundred and fortieth part, the time required for the maturity of each being taken at seventy to seventy-five years. It seems incredible that a subject fraught with such momentous consequences to the nation should have been wholly or entirely overlooked by those who have the dis-

posal of our resources, and that no steps should have been ever thought of to effect a purpose which would immortalize the memories of those who should first set about it, and lay the foundation for wiping off the national disgrace of being without forests, whilst we have the most ample means of creating them. Besides the common and well-known advantages of the larch, which are in the quick growth and unparalleled excellence of the wood, there are other not less cogent reasons for recommending it as the chief or staple produce in a system of national forests. Not only the thinnings are more productive than those of any other tree, but the prodigious increase of value in the soil which is derived from the fertilizing power of its spiculæ must be taken into account. In fifteen to twenty years lands planted with it could be safely let as sheep pasture, and the rents would soon increase so as probably to defray the expense of purchase, or at last pay a very good interest for the money expended in the first instance; thus adding another increase of national resources by converting waste into productive soil.

Besides the low value of land in these districts, which is so strong an œconomical recommendation, there are others in favour of the north of Scotland. The rocks in the Grampians are chiefly primary and many of them igneous, which are extremely favourable to the growth of timber, especially of the larch, which requires free drainage and a dry subsoil. In this description of ground alone is the tree seen in its true form as in the alpine forests, throwing out enormous arms and vying in picturesque beauty with the other inhabitants of the woods. It may be urged, in answer to these observations, that there are abundant plantations already in the hands of private individuals, and that in case of need the country will have the benefit of their outlay. It is very clear that no certainty can exist in such calculations. The caprice, extravagance, avarice, or cupidity of private persons may at any time operate to the serious injury of the public. What has become of the ancient Caledonian forests, the last remains of which have been swept away in this generation? The history of the mines which surround us is sufficient proof how little individuals frequently look beyond the moment they require pecuniary supplies.

The volcanic appearance of the heights on every side, and the treasures which are being consumed for ever, are sufficient proof of the futility of calculating on such resources, and show that we ought to create them, as we have the power to do, in fee simple, making ourselves alike independent of individuals and foreigners.

By devoting 100,000 acres, which is about the size of the larger Highland estates, to this purpose, we should in seventy to seventy-five years, proceeding on the calculation of the Duke of Athol, that in the same period his forests would be worth five to six millions sterling, be possessed of national capital to the amount of fifty to sixty millions in timber alone, besides a large tract of mountain pasture returning an ample annual revenue, and all this with an outlay in the first instance comparatively trifling. It is needless to observe that this immense result cannot be obtained, or even the entire foundation laid, in a moment, but must be attained by steady and systematic perseverance, like that of the individuals above-mentioned who have bequeathed us so noble an example. By the creation of forests on this scale, we should make some reparation for the consumption and destruction of the vast mineral treasures, on which vital staple of national wealth the operations of this generation will about that period begin to be seriously felt.

Although the larch unquestionably far exceeds every other tree for the purpose we are speaking of, it would be most desirable that some of the evergreens should be grown on scales according to the results of experience of their utility and the fitness of the soil and situation to bring them to perfection. It is hardly necessary to observe that we should only recommend those of first-rate properties, as shown in the list we have gone through.

The *P. Cembra*, of which the timber is perhaps superior to that of any other species, labours under the disadvantage of being extremely slow of growth. However, the trials made in this country are as yet not sufficient; and it can only be fairly tried on dry hills or mountain sides, clay soil and flats being unsuited to it; and very probably it might be improved by grafting the *P. sylvestris* in the Tchoudy manner.

The *uncinata* is considerably quicker in growth than the

Cembra, and being superior in quality to the *sylvestris,* would require trial as soon as seeds could be procured in sufficient quantity, which at present must be done from the forests in the Spanish Pyrenees. The *sylvestris* of course would have its place in localities suited to it.

The spruce would claim the greatest consideration, especially in damp soil, which might be found unfavourable to the larch, and where warmth and shelter were required. It is extraordinary that in a country so congenial with Norway this tree should not have been tried on a larger scale by the Highland proprietors. We remember being struck with the grandeur it would impart to the magnificent though denuded fall of Fyers.

The silver fir would no doubt repay the cultivation in certain localities suited to it, its growth being very rapid; and it resists the wind much better than its last-mentioned congener. The writer knew an instance where, near Plymouth, the proprietor of an estate there was offered by the people of the dock-yard 100 guineas for a single tree of this species; it was during the war and the highest prices; but as that tree would not occupy a space of more than forty feet in diameter, we may conceive the value of an acre covered with such trees*, and its age probably was not above seventy years. An establishment of the sort we are contemplating would require space to be devoted to trials of such other species as might prove desirable to acclimatize, such, for instance, as the *P. austriaca* and *Pallasiana, A. Douglasii, A. pichta,* &c. &c.

We must now conclude with a few hints to individuals on other species, more especially to those who reside or have pro-

* Since this paper was read the writer has received a communication from Mr. Salvin of Croxdale, near Durham, who possesses extensive woods and has given much attention to the subject. He states that the silver fir, when felled and left on the ground, resists the effects of a humid climate and damp soil, well fitted for such a trial, better than the larch. As it is perfectly well known that the timber of the one species is very much inferior to that of the other, we were at first rather struck with this curious fact. It is strongly denied that there is any inferiority or defect in the larch such as is apt to be the case when grown in soil unsuited to it, which indeed rather affects the inside than the outside of the tree. The solution we suspect to be the following: that the heart of the timber is preserved by the turpentine, which is deposited in the outer layers; and we hasten to announce this most important and valuable information, in order that experiments may be made on the silver fir as pile timber, for which, if the phænomenon here mentioned be general, the tree will, in every respect, be most admirably suited.

perties in the west and south of England. The larch cannot be grown to much profit as timber on cold wet lands, whatever be the climate. The pines of the middle class, *P. Laricio* and *P. hispanica*, we have not the smallest doubt might be grown to advantage on Dartmoor or Exmoor, South Wales, &c., and it is to be regretted that proprietors should have planted so bad and useless a tree as the *Pinaster*, which has been done in some of those counties, where these better species would thrive equally well or better.

The cedar of Lebanon might be grown for profit by care at first in any part of the south of England. They may be easily raised from cuttings, the modes of which as well as the grafting pines may be found in that excellent work Loudon's 'Arboretum', the vast quantity, and condensation of information in which makes it invaluable to the tree cultivator. The prejudice against trees raised in this manner is quite unfounded: we might with quite as much reason declaim against propagating by layers, which, in many species, is our only resource when the tree does not ripen seeds in this climate.

We have one more observation to make respecting the larch, which is more particularly addressed to those who possess estates in the adjacent counties, and especially in the higher and colder parts. It is to call their attention to the planting larch as an improver of soil. There is no doubt whatever, by draining our cold clays, and planting larch alone, that after fifteen to twenty years thinning them to open order, sheep could be admitted with perfect safety. After that, by regularly opening them out, the land would be prodigiously increased in value as pasture, and the last trees could remain until they were wanted, or that the tops should supply the unerring information that they had done their best and must be cut down. It is necessary to observe that belts or strips will not answer the purpose, but that planting with this view should be in solid masses, or squares or oblongs, from east to west, and also that in this system we do not recommend, but on the contrary deprecate, the mixture of other trees, especially oaks, to the vain and useless hope of growing which so much capital is uselessly expended. In short, according to our calculation, the larch is to be used merely as a fructifier

or ameliorator, the trees remaining to defray the expense and loss of time. The prejudice of the damage done to trees by sheep is groundless, compared to the benefit to be derived from their use as here recommended; and we are quite sure that it could be acted on with the greatest benefit to the land and to that of the vicinity by the shelter afforded, and that the value of every estate, large or small, would be very much increased by the general adoption of such a plan.

S. E. Cook.

Carlton, 16th August.

XX.—*Letter from* Captain DuCane, R.N., *to the* Rev. Leonard Jenyns, *on the subject of the Metamorphosis of* Crustacea*. With Plates VI. and VII.

Southampton, August 20, 1838.

Sir,

The British Association for the Advancement of Science having requested me to present a report at its Meeting at Newcastle this year on the subject of the metamorphoses of the *Crustacea* in the Southampton waters, I beg to trouble you with the following observations relative to the metamorphoses of the ditch prawn (*Palæmon variabilis*) and common shrimp (*Crangon vulgaris*), which I shall be obliged by your laying before the Association.

I last year, through Mr. MacLeay, presented drawings of the larva of the ditch prawn, exhibiting the appearance it presented from the time of its first exclusion from the egg till the end of the third day, when my specimens died. I have not this year been able again to obtain the larva of the prawn direct from the egg; but the ditch which is the locality of this particular species, having supplied me with the larva in great abundance, I have been enabled very satisfactorily to trace the various changes it is subject to in the progress towards its adult state.

These changes, as shown in the accompanying drawings, are four in number; the three last may however, I think, rather be considered as a gradual and progressive development

* This important letter arrived at Newcastle too late to be read at the Section of Zoology and Botany.—Edit.